

Amendments to the Claims:

Following is a complete listing of the claims pending in the application, as amended:

1-2. (Cancelled)

3. (Original) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet having a frame, at least one upper panel enclosing an upper compartment, and at least one lower panel enclosing a lower compartment, wherein the lower panel has an opening, and wherein the cabinet defines an interior enclosure;

a lift/rotate assembly having a housing rotatably coupled to an external portion of the frame to tilt outward relative to the frame, mechanical lift components in the housing, and a door coupled to the housing, wherein the door is received in the opening of the lower panel of the cabinet; and

an electrochemical processing station comprising -

(a) a reaction vessel in the interior enclosure, the reaction vessel comprising a container and at least one electrode in the container, and

(b) a head assembly carried by the lift/rotate assembly, the head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the reaction vessel during a processing cycle.

4-5. (Cancelled)

6. (Original) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

a first electrochemical processing station comprising -

(a) a first reaction vessel in the interior enclosure, the first reaction vessel comprising a first container, a first field shaping unit in the first container, and a

plurality of separate first electrodes, wherein the first field shaping unit includes first electrode compartments that each contain one of the first electrodes, and

(b) a first head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the first field shaping unit during a processing cycle;

a second electrochemical processing station comprising -

(a) a second reaction vessel in the interior enclosure, the second reaction vessel comprising a second container, a second field shaping unit in the second container, and a plurality of separate second electrodes, wherein the second field shaping unit includes second electrode compartments that each contain one of the second electrodes, and

(b) a second head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the second field shaping unit during a processing cycle;

a first power supply having a first electrical link coupled to the first electrodes in the first reaction vessel; and

a second power supply having a second electrical link coupled to the second electrodes in the second reaction vessel separately from the first power supply.

7. (Currently Amended) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

an electrochemical processing station comprising -

(a) a reaction vessel in the interior enclosure, the reaction vessel comprising a container and at least one electrode in the container, and

(b) a head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the reaction vessel during a processing cycle; and

a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising -

(a) an arm assembly including an arm that moves along a lift path and/or rotates about the lift path, and

~~(e)~~(b) first and second end-effectors carried by the arm, wherein the first and second end-effectors rotate relative to the arm about at least one rotation axis generally parallel to the lift path.

8. (Currently Amended) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

an electrochemical processing station comprising -

(a) a reaction vessel in the interior enclosure, the reaction vessel comprising a container and at least one electrode in the container, and

(b) a head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the reaction vessel during a processing cycle; and

a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising -

(a) an arm assembly including an arm that moves along a lift path and/or rotates about the lift path, and

~~(e)~~(b) first and second end-effectors carried by the arm, wherein the first and second end-effectors rotate relative to the arm about at least one rotation axis generally parallel to the lift path, and wherein the first end-effector is spaced apart from the arm by a first distance to rotate through a first plane and the second end-effector is spaced apart from the arm by a second distance to rotate through a second plane separate from the first plane.

9. (Currently Amended) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

an electrochemical processing station comprising -

(a) a reaction vessel in the interior enclosure, the reaction vessel comprising a container, a plurality of electrodes in separate electrode compartments in the container, and at least one interface member coupled to at least one of the electrode compartments between a corresponding electrode and a workpiece processing site, the interface member being configured to prevent selected matter from

passing from the electrode compartment containing the corresponding electrode to the workpiece processing site, and

(b) a head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the reaction vessel during a processing cycle; and

a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising -

(a) an arm assembly including an arm that moves along a lift path and/or rotates about the lift path, and

~~(e)~~(b) at least a first end-effector carried by the arm.

10. (Original) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure, the cabinet having a frame and panels attached to the frame to define the interior enclosure;

an electrochemical processing station comprising -

(a) a reaction vessel in the interior enclosure, the reaction vessel comprising a container and at least one electrode in the container, and

(b) a head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the reaction vessel during a processing cycle;

a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising -

(a) an arm assembly including an arm that moves along a lift path and/or rotates about the lift path, and

(b) first and second end-effectors carried by the arm, wherein the first and second end-effectors rotate relative to the arm; and

a lift/rotate assembly having a housing rotatably coupled to an external portion of the frame to tilt outward relative to the frame, mechanical lift components in the housing, and a door coupled to the housing, wherein the door is accessible to be opened without opening the cabinet.

11. (Currently Amended) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising -

(a) an arm assembly including an arm that moves along a lift path and/or rotates about the lift path, and

~~(c)~~(b) first and second end-effectors carried by the arm, wherein the first and second end-effectors rotate relative to the arm; and

a first electrochemical processing station comprising -

(a) a first reaction vessel in the interior enclosure, the first reaction vessel comprising a first container and a plurality of separate first electrodes in the first container, and

(b) a first head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the first reaction vessel during a processing cycle;

a second electrochemical processing station comprising -

(a) a second reaction vessel in the interior enclosure, the second reaction vessel comprising a second container and a plurality of separate second electrodes in the second container, and

(b) a second head assembly having a workpiece holder configured to hold a microelectronic workpiece relative to the second reaction vessel during a processing cycle;

a first power supply having a first electrical link coupled to the first electrodes in the first reaction vessel; and

a second power supply having a second electrical link coupled to the second electrodes in the second reaction vessel.

12. (New) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

an electrochemical processing unit in the cabinet, the electrochemical processing unit comprising a head assembly having a workpiece holder with a plurality of electrical contacts arranged to engage a perimeter portion of a microelectronic workpiece and a processing chamber aligned with the head assembly, the processing chamber comprising (a) an outer housing, (b) a reaction vessel in the outer housing, the reaction vessel having an inlet through which an electrochemical processing solution flows into the processing chamber and a weir over which the electrochemical processing fluid flows into the outer housing, (c) a first electrode compartment in the reaction vessel and a second electrode compartment in the reaction vessel concentric with the first electrode compartment, and (d) a plurality of electrodes including a first electrode in the first electrode compartment and a second electrode in the second electrode compartment; and

a controller operatively coupled to the first and second electrodes, wherein the controller is configured to provide an independent electrical current to each of the first and second electrodes.

13. (New) The tool of claim 12 wherein the processing chamber further comprises a field shaping unit between the workpiece holder and the first and second electrodes, and wherein the field shaping unit is configured to shield at least a portion of the microelectronic workpiece from the first and second electrodes.

14. (New) The tool of claim 13 wherein the first electrode compartment is separated from the second electrode compartment by an annular wall, and wherein the field shaping unit comprises an annular lateral dielectric section attached to the annular wall.

15. (New) The tool of claim 13 wherein the field shaping unit comprises a first annular lateral section over at least a portion of the first electrode and a second annular lateral section over at least a portion of the second electrode.

16. (New) The tool of claim 12 wherein the first electrode is a first annular conductive ring and the second electrode is a second annular conductive ring.

17. (New) The tool of claim 16 wherein the processing chamber further includes a flow director in the reaction vessel that directs a flow of processing solution generally along a central area of the reaction vessel within the first annular conductive ring.

18. (New) The tool of claim 12 wherein the processing chamber further comprises an interface member between the first electrode and the weir of the reaction vessel, the interface member being configured to inhibit particles from flowing from the first electrode compartment to the weir.

19. (New) The tool of claim 19 wherein the interface member comprises a filter.

20. (New) The tool of claim 19 wherein the interface member comprises an ion-membrane.

21. (New) The tool of claim 19 wherein the processing chamber further comprises a primary flow guide configured to direct a primary flow of a catholyte to the workpiece holder, a secondary flow system configured to direct a secondary flow of an anolyte through the first and second electrode compartments, and the interface member comprises an ion-membrane between the primary flow and the secondary flow that preferentially allows ions to pass between the secondary flow and the primary flow.

22. (New) The tool of claim 12, further comprising a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising an arm assembly including an arm that moves and/or rotates relative to a lift path, a first end-effector rotatably attached to the arm at a first elevation, and a second end-effector rotatably attached to the arm at a second elevation above the first elevation.

23. (New) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

an electrochemical processing unit in the cabinet, the electrochemical processing unit comprising a head assembly having a workpiece holder with a plurality of electrical contacts arranged to engage a perimeter portion of a microelectronic workpiece and a processing chamber aligned with the head assembly, the processing chamber comprising (a) a reaction vessel having an inlet through which an electrochemical processing solution flows into the processing chamber, (b) a plurality of electrodes in the reaction vessel including a first annular electrode and a second annular electrode concentric with respect to the first annular electrode, and (c) a field shaping unit in the reaction vessel comprising an annular lateral section of a dielectric material between the second electrode and the workpiece holder to shape an electric field generated by the first electrode at a peripheral region of the workpiece holder; and
a controller operatively coupled to the first and second electrodes, wherein the controller is configured to provide an independent electrical current to each of the first and second electrodes.

24. (New) The tool of claim 23 wherein the field shaping unit further comprises a first annular lateral section over at least a portion of the first electrode and a second annular lateral section over at least a portion of the second electrode.

25. (New) The tool of claim 23 wherein the first electrode is a first annular conductive ring and the second electrode is a second annular conductive ring.

26. (New) The tool of claim 25 wherein the processing chamber further includes a flow director in the reaction vessel that directs a flow of processing solution along a central area of the reaction vessel and within the first annular conductive ring.

27. (New) The tool of claim 23 wherein the processing chamber further comprises an interface member between the first electrode and the workpiece holder, and wherein the interface member is configured to inhibit particles from flowing from the first electrode to the workpiece holder.

28. (New) The tool of claim 27 wherein the interface member comprises a filter.

29. (New) The tool of claim 27 wherein the interface member comprises an ion-membrane.

30. (New) The tool of claim 27 wherein the processing chamber further comprises a primary flow guide configured to direct a primary flow of a catholyte toward the workpiece holder, a secondary flow system configured to direct a secondary flow of an anolyte through by the first and second electrode compartments, and the interface member comprises an ion-membrane between the primary flow and the secondary flow that preferentially allows ions to pass between the secondary flow and the primary flow.

31. (New) The tool of claim 23, further comprising a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising an arm assembly including an arm that moves and/or rotates relative to a lift path, a first end-effector rotatably attached to the arm at a first elevation, and a second end-effector rotatably attached to the arm at a second elevation above the first elevation.

32. (New) A tool for electrochemical processing of microelectronic workpieces, comprising:

- a cabinet defining an interior enclosure;

- an electrochemical processing unit in the cabinet, the electrochemical processing unit comprising a head assembly having a workpiece holder with a plurality of electrical contacts arranged to engage a perimeter portion of a microelectronic workpiece and a processing chamber aligned with the head assembly, the processing chamber comprising (a) a reaction vessel having an inlet through which an electrochemical processing solution flows into the processing chamber, (b) a plurality of electrodes in the reaction vessel including a first annular electrode and a second annular electrode concentric with respect to the first annular electrode, and (c) a field shaping unit in the reaction vessel configured to substantially shield at least a portion of

a workpiece held in the workpiece holder from line of sight exposure from at least one of the first and second annular electrodes; and

a controller operatively coupled to the first and second electrodes, wherein the controller is configured to provide an independent electrical current to each of the first and second electrodes.

33. (New) The tool of claim 32, further comprising an annular first electrode compartment in which the first annular electrode is positioned, an annular second electrode compartment in which the second annular electrode is positioned, and an annular wall separating the first and second electrode compartments.

34. (New) The tool of claim 33 wherein the field shaping unit comprises a lateral dielectric section attached to the annular wall.

35. (New) The tool of claim 32 wherein the field shaping unit comprises a first annular lateral dielectric section over at least a portion of the first electrode and a second annular lateral dielectric section over at least a portion of the second electrode.

36. (New) The tool of claim 32 wherein the first electrode is a first annular conductive ring and the second electrode is a second annular conductive ring.

37. (New) The tool of claim 36 wherein the processing chamber further includes a flow director in the reaction vessel configured to direct flow along a central area of the reaction vessel and within the first annular conductive ring surrounds the flow director.

38. (New) The tool of claim 33 wherein the processing chamber further comprises an interface member between the first annular electrode and the workpiece holder, the interface member being configured to inhibit particles from flowing from the first annular electrode to the workpiece holder.

39. (New) The tool of claim 38 wherein the interface member comprises a filter.

40. (New) The tool of claim 38 wherein the interface member comprises an ion-membrane.

41. (New) The tool of claim 38 wherein the processing chamber further comprises a primary flow guide configured to direct a primary flow of a catholyte toward the workpiece holder, a secondary flow system configured to direct a secondary flow of an anolyte through the first and second electrode compartments, and the interface member comprises an ion-membrane between the primary flow and the secondary flow that preferentially allows ions to pass between the secondary flow and the primary flow.

42. (New) The tool of claim 32, further comprising a transfer device for handling workpieces in the cabinet, the transfer device having a robot comprising an arm assembly including an arm that moves and/or rotates relative to a lift path, a first end-effector rotatably attached to the arm at a first elevation, and a second end-effector rotatably attached to the arm at a second elevation above the first elevation.

43. (New) A tool for electrochemical processing of microelectronic workpieces, comprising:

a cabinet defining an interior enclosure;

an electrochemical processing unit in the cabinet, the electrochemical processing unit comprising a head assembly having a workpiece holder with a plurality of electrical contacts arranged to engage a perimeter portion of a microelectronic workpiece and a processing chamber aligned with the head assembly, the processing chamber comprising (a) a reaction vessel having an inlet through which an electrochemical processing solution flows into the processing chamber, (b) a plurality of electrodes in the reaction vessel including a first electrode and a second electrode concentric with respect to the first annular electrode in the reaction vessel, and (c) a first interface member between the first electrode and the workpiece holder configured to

inhibit selected matter in the processing solution from reaching the workpiece holder;
and

a controller operatively coupled to the first and second electrodes, wherein the controller is configured to provide an independent electrical current to each of the first and second electrodes.

44. (New) The tool of claim 43 further comprising a second interface member between the second electrode and the workpiece holder configured to inhibit selected matter in the processing solution from reaching the workpiece holder.

45. (New) The tool of claim 43 wherein the interface member comprises a filter configured to filter particulate matter from the processing solution.

46. (New) The tool of claim 43 wherein the interface member comprises a filter configured to filter particulate matter and bubbles from the processing solution.

47. (New) The tool of claim 43 wherein the interface member comprise an ion membrane.

48. (New) The tool of claim 43 wherein the processing chamber further comprises a primary flow guide configured to direct a primary flow of a catholyte to the workpiece holder, a secondary flow system configured to direct a secondary flow of an anolyte through the first and second electrode compartments, and the interface member comprises an ion-membrane between the primary flow and the secondary flow that preferentially allows ions to pass between the secondary flow and the primary flow.